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| 10/621,194 | 07/15/2003 | Ford B. Grigg | 108298637US1 | 2349 |
| 25096 | 7590 | 02/09/2006 | EXAMINER | |
| PERKINS COIE LLP | | | ANDUJAR, LEONARDO | |
| PATENT-SEA | | | | |
| P.O. BOX 1247 | | | ART UNIT | |
| SEATTLE, WA 98111-1247 | | | 2826 | |
| | | | PAPER NUMBER | |

DATE MAILED: 02/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/621,194

Applicant(s)

GRIGG, FORD B.

Examiner

Leonardo Andújar

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 November 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 38-45 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 38-45 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 July 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/29/2005 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

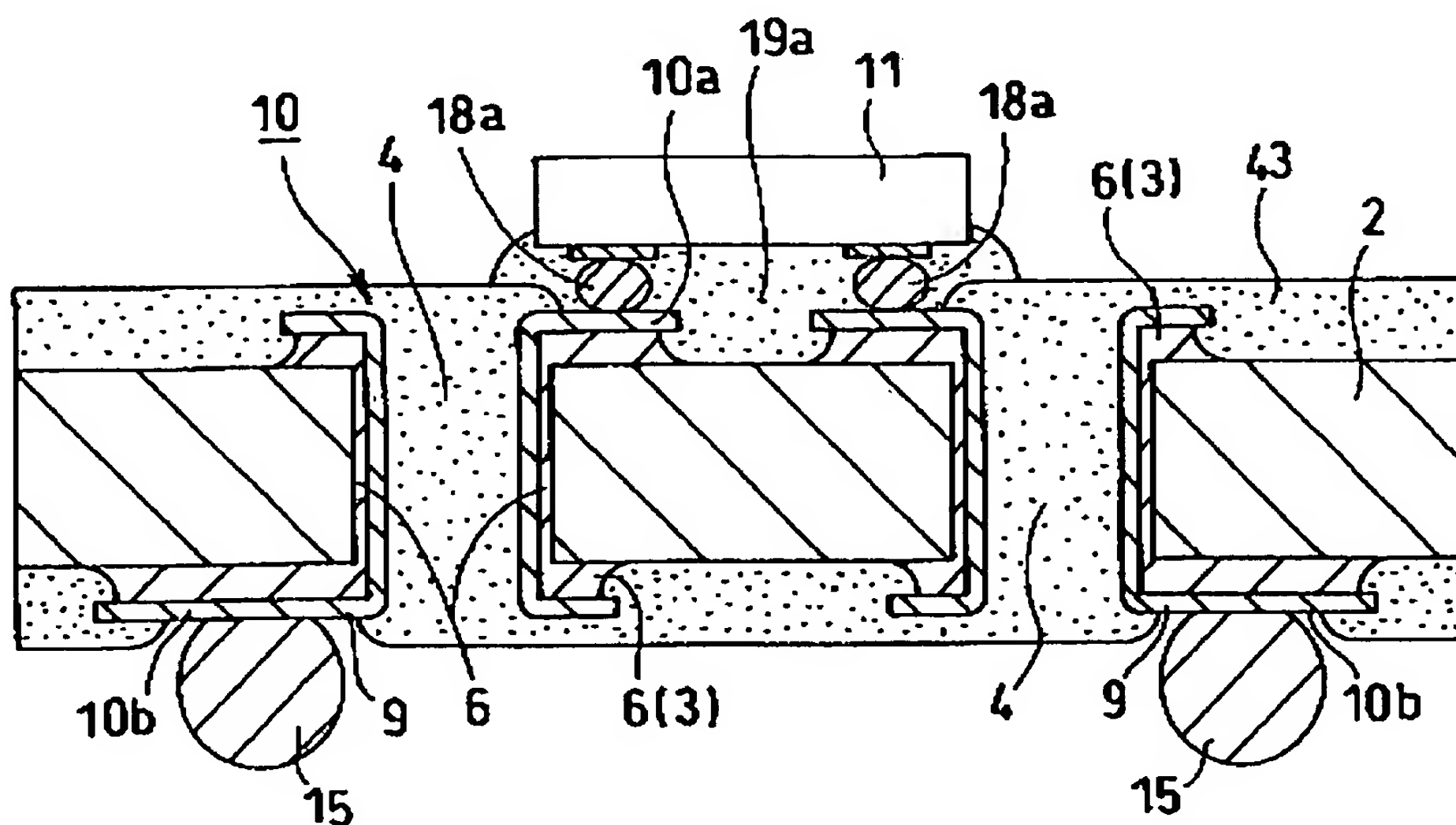
3. Claims 38-41 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata et al. (US 6,249,053) in view of Shoji (JP 10-98045).

4. Regarding claim 38, Nakata (e.g. fig. 13) shows a microelectronic die having an integrated circuit 11 and a plurality of bond-pads (the die region contacting the bumps 18a) coupled to the integrated circuit; an interposer substrate 2 having a first side coupled to the die, a second side opposite the first side, a plurality of ball-pads 10b arranged on the second side to be coupled to a printed circuit board (col. 9/lis. 52-53), interconnects 18a electrically coupled to the bond-pads on the die and the ball pads, a plurality of traces lines 9 adjacent to the ball pads (the layer 9 in front/back in the paper

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direction, see fig. 2a) and a solder-mask 43 having openings over the ball-pads wherein at least a portion of at least one of the plurality of trace lines is exposed in the opening; a plurality of solder-balls 15 arranged so that each solder-ball is in an opening in the solder-mask and contacting a corresponding ball-pad. Nakata does not show a dielectric compound surrounding a portion of the perimeter of each of the ball-pads and the solder-balls such that all the ball pads and solder balls are electrically insulated from any exposed portion of the plurality of traces lines.

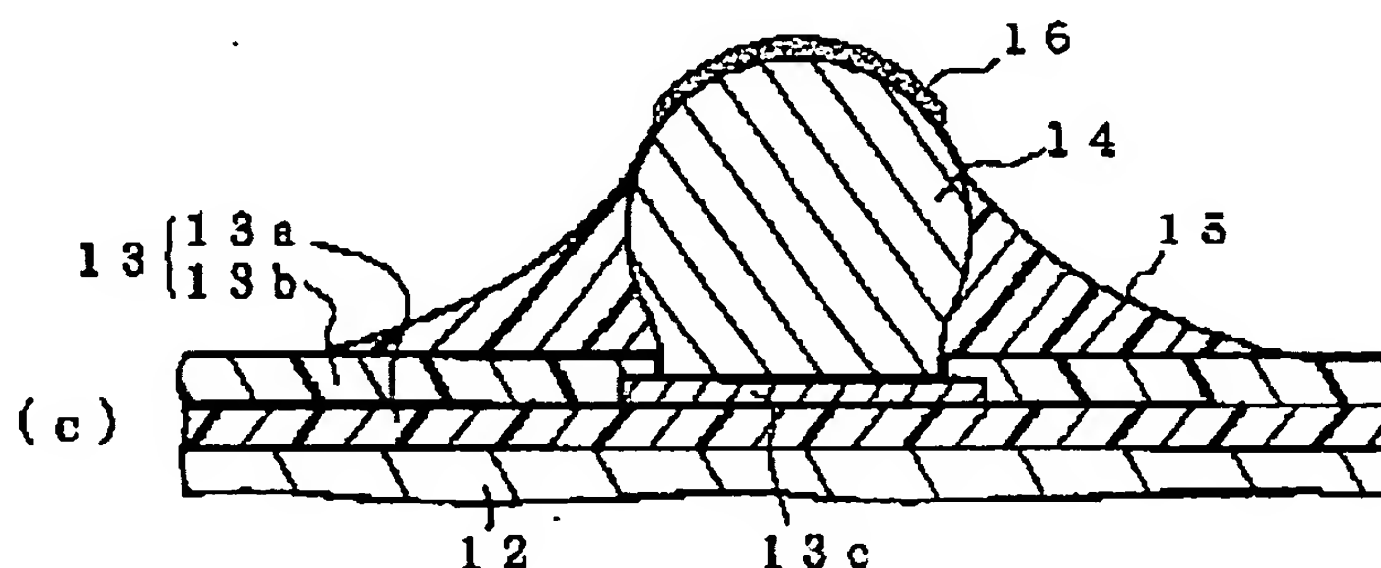
Fig. 13



Nevertheless, Shoji (e.g. fig. 3c) shows a dielectric compound 15 (e.g. polyimide; see attached translation pp 0028) surrounding a portion of the perimeter of the ball-pads 13 and the solder-balls 14. Because the base of a solder ball/projection electrode 14 can be reinforced by the film/dielectric compound 15, even when the coefficient of thermal expansion of two members which connect through this projection electrode

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differs greatly, a crack etc. does not arise with thermal stress in a projection electrode. And since reinforcement can be carried out only to the base of a projection electrode, it is not necessary to make the member for reinforcement intervene between two members which connect mutually through this projection electrode. For this reason, since said two members can be made to separate after mounting so that a projection electrode may become on a boundary, this is easily exchangeable even if one side of these two members is a defective (i.e. easy reworkability, see 0051)



It would have been obvious to one of ordinary skill in the art at the time the invention was made to form a dielectric compound surrounding a portion of the perimeter of each of the ball-pads and the solder-balls disclosed by Nakata including a portion of the perimeter of each of the ball-pads and the solder-balls as suggested by Shoji to prevent cracks due to difference in thermal expansion coefficient while providing easy reworkability. In the present combination the ball pads and solder balls are electrically insulated from any exposed portion of the plurality of traces lines.

5. Regarding claim 39, Shoji teaches that the dielectric compound includes a flux or a liquid component (see attached translation 0026).

6. Regarding claims 40 and 45, Nakata (e.g. fig. 13) shows a microelectronic die having an integrated circuit 11 and a plurality of bond-pads (the die region contacting the bumps 18a) coupled to the integrated circuit; an interposer substrate 2 having a first side coupled to the die, a second side opposite the first side, a ball-pad 10b arranged on the second side, an interconnect 18a electrically coupled to the bond-pad on the die and the ball pad, a trace line 9/3 adjacent to the ball pad (the layer 9 in front/back in the paper direction, see fig. 2a), and a solder-mask 43 on the second side having an opening over the ball-pad and at least a portion of the trace line; a solder-ball 15 on the ball pad. Nakata does not teach a dielectric compound in the opening that electrically insulates the ball pad and the solder ball from any exposed portion of the adjacent line in the opening. Nevertheless, Shoji (e.g. fig. 3c) shows a dielectric compound 15 (e.g. polyimide; see attached translation pp 0028) surrounding a portion of the perimeter of the ball-pads 13 and the solder-balls 14. Because the base of a solder ball/projection electrode 14 can be reinforced by the film/dielectric compound 15, even when the coefficient of thermal expansion of two members which connect through this projection electrode differs greatly, a crack etc. does not arise with thermal stress in a projection electrode. And since reinforcement can be carried out only to the base of a projection electrode, it is not necessary to make the member for reinforcement intervene between two members which connect mutually through this projection electrode. For this reason, since said two members can be made to separate after mounting so that a projection electrode may become on a boundary, this is easily exchangeable even if one side of

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these two members is a defective (i.e. easy reworkability, see attached translation 0051)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form dielectric compound surrounding a portion of the perimeter of each of the ball-pads and the solder-balls disclosed by Nakata including a portion of the perimeter of each of the ball-pads and the solder-balls as suggested by Shoji to prevent cracks due to difference in thermal expansion coefficient while providing easy reworkability as taught by Shoji. In the instant combination, the exposed portions of the trace 9/3 and the base of the solder ball 15 must be covered by the polyimide resin 15 to properly achieve the reinforcement suggested by Shoji because the base and the trace's portions are located inside the opening and the insulating resin must surround the solder ball base. Therefore, the exposed portions are covered.

7. Regarding claim 41, Shoji teaches that the dielectric compound includes a flux or a liquid component (0026).

8. Claims 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata et al. (US 6,249,053) in view of Shoji (JP-10-98045) further in view of Iwasaki (US 5,834,848).

9. Regarding claim 42, Nakata in view of Shoji shows most aspects of the instant invention including a circuit board (i.e. motherboard) coupled to the solder balls. Nakata in view of Shoji does not teach that the circuit board has a contact coupled to the solder ball. However, Iwasaki (e.g. fig. 1) shows a circuit board/motherboard 21 having contacts 21a coupled to the solder balls 31 of the semiconductor package 10. It would

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have been obvious to one of ordinary skill in the art at the time the invention was made to include contacts in the circuit board disclosed by Nakata in view of Shoji and to couple the solder balls to this contacts to establish the electrical path required to integrate the semiconductor package into the overall electronic system and to make the device operable.

10. Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata et al. (US 6,249,053) in view of Shoji (JP-10-98045) further in view of Iwasaki (US 5,834,848) further in view of Imai et al. (US 6,285,083).

11. Regarding claim 43, Nakata in view of Shoji further in view of Iwasaki shows most aspects of the instant invention except for a eutectic paste proximate to the contact. Nonetheless, Imai teaches that the use of a eutectic solder proximate to the contact produces a solder attachment having a higher resistance to fatigue (col. 4/lis. 33-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include a eutectic paste proximate to the contact disclosed by Nakata in view of Shoji further in view of Iwasaki in order to make the attachment having a higher resistance to fatigue as suggested by Imai.

12. Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata et al. (US 6,249,053) in view of Shoji (JP-10-98045) further in view of Imai et al. (US 6,285,083).

13. Regarding claim 44, Nakata in view of Shoji shows most aspects of the instant invention except for a eutectic paste proximate to the contact. Nonetheless, Imai teaches that the use of a eutectic solder proximate to the contact produces a solder

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attachment having a higher resistance to fatigue (col. 4/lis. 33-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include a eutectic paste proximate to the contact disclosed by Nakata in view of Shoji in order to make the attachment having a higher resistance to fatigue as suggested by Imai.

Response to Arguments

14. Applicant's arguments with respect to claims 39-45 have been considered but are not persuasive. Initially, the examiner disagrees with applicant that currently amended claims 38 and 40 distinguish over the teaching of the prior art. Initially, the prior art teaches a plurality of traces adjacent to the ball pads and exposed in the openings. As stated above, the interposer disclosed by Nakata includes a plurality of traces (see fig. 2). As it is known in art an interposer includes plurality of solder ball rows wherein each of the solder balls is attached to individual traces (note that the prior art is interpreted in view of one having ordinary skills in the art). Since figure 13 is a sectional view the traces 9 that are in front or behind of depicted trace 9 cannot be viewed. In this case, the sectional view suggests multiples traces in the opening that are eclipsed by the trace 9 (see for example fig. 2a). On the other hand, Shoji (e.g. fig. 3c) shows a dielectric compound 15 (e.g. polyimide; see attached translation pp 0028) surrounding a portion of the perimeter of the ball-pads 13 and the solder-balls 14. In the instant combination, the exposed portions of the trace 9/3 and the base of the solder ball 15 must be covered by the polyimide resin 15 to properly achieve the reinforcement suggested by Shoji because the base and the trace's portions are located inside the

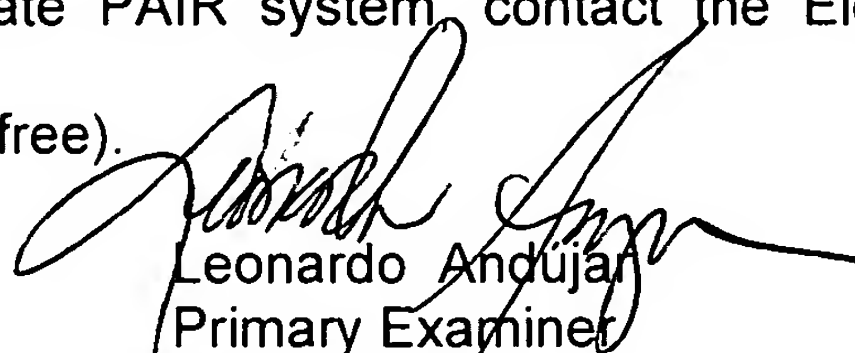
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opening and the insulating resin must surround the solder ball base. Therefore, adjacent exposed portions are insulated from each other.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Leonardo Andújar whose telephone number is 571-272-1912. The examiner can normally be reached on Mon through Thu from 9:00 AM to 7:30 PM EST. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J. Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

16. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Leonardo Andújar
Primary Examiner
Art Unit 2826